WHAT IS CLAIMED IS:

1. An apparatus for measuring a magnetic flux of a synchronous reluctance motor, the apparatus comprising:

a flux output estimator that estimates a flux of a synchronous reluctance motor by removing higher harmonic components of a current, in a rotational coordinate system, which flows into the motor;

a flux measurer that measures a flux in a fixed coordinate system by combining a voltage, in the fixed coordinate system, which is applied to the motor, and a current in the fixed coordinate system, from which higher harmonic components are removed, with the estimated flux output from the flux output estimator; and

a fixed/rotational coordinate converter that converts the measured flux output from the flux output measurer to a measured flux in the rotational coordinate system.

2. The apparatus as set forth in claim 1, wherein the flux output estimator includes:

a low pass filter that removes the higher harmonic components of the current in the rotational coordinate system;

an estimated flux selector that selects and outputs a flux value corresponding to the current, from which the higher harmonic components are removed, with reference to information stored in a look-up table which describes fluxes in correlation with currents; and

a rotational/fixed coordinate converter that converts the output estimated flux to an estimated flux in the fixed coordinate system.

3. The apparatus as set forth in claim 1, wherein the flux measurer includes:

a band pass filter that removes the higher harmonic components from the current in the fixed coordinate system;

a phase resistance section that multiplies the current passing through the band pass filter by a phase resistance;

a first adder that adds the current output from the phase resistance section and the voltage in the fixed coordinate system;

a second adder that adds the output value from the first adder and the estimated flux output from the flux output estimator;

an integrator that integrates the output value from the second adder; and

a third adder that adds the measured flux output from the integrator and the estimated flux output from the flux output estimator, and outputs the added flux to the second adder.

4. The apparatus as set forth in claim 3, wherein the flux measurer further includes a gain unit for multiplying the added flux output from the third adder by a reference gain value, and outputs the resulting value to the second adder.

5. The apparatus as set forth in claim 3, wherein low and high cutoff frequencies of the band pass filter are determined by the following equation:

$$f_l\,, f_h = 0.0707 f_{\tilde{\omega}}$$

where f_l denotes the low cutoff frequency of the band pass filter, f_h denotes the high cutoff frequency thereof, and the $f_{\tilde{\omega}}$ denotes a frequency corresponding to an estimated speed of the motor.

6. A sensorless control system of a synchronous reluctance motor, the system comprising:

a sensorless controller that measures a magnetic flux of a synchronous reluctance motor and that estimates a rotation angle and speed of the motor based on the measured flux in to control the motor;

a low-speed-region tracker, which is activated or not activated based on the estimated speed of the motor, that measures the rotation angle and speed of a rotor of the motor so as to compensate the estimated rotation angle and the estimated speed of the sensorless controller; and

a mode switching controller that controls whether to activate the low-speed-region tracker based on the estimated speed of the motor, and stabilizes chattering phenomena caused by the turning on or off of the low-speed-region tracker.

7. The sensorless control system as set forth in claim 6, wherein the sensorless controller includes:

a flux observer that outputs the measured speed and the estimated speed based on a voltage and a current in a fixed coordinate system which are input to the motor;

a rotation angle estimator that estimates the rotation angle of the rotor based on the estimated flux and the measured flux output from the flux observer; and

a speed estimator for estimating the speed of the rotor based on the estimated rotation angle of the rotation angle estimator,

wherein said low-speed-region tracker converges the measured speed to a real speed of the motor by converging the measured rotation angle to a real rotation angle of the motor, based on a variable whose value varies according to the estimated speed of the motor and which has a higher value when the estimated speed is low, and a lower value when the estimated speed is high, and

wherein said mode switching controller controls whether to activate the low-speed-region tracker by detecting a variation of the variable in such a manner that, when the estimated speed of the motor increases from a low speed to a high speed, the low-speed-region tracker is turned off when the estimated speed reaches a first speed, and, when the estimated speed of the motor decreases from a high speed to a low speed, the low-speed-region tracker is turned on when the estimated speed reaches a second speed lower than the first speed.

8. The sensorless control system as set forth in claim 7, wherein the low-speed-region tracker includes:

a proportional measured-speed measurer that outputs a measured speed proportional to the position of the rotor based on the flux measured by the flux observer;

a reference signal combiner that combines a reference signal with a value obtained by adding the estimated speed output from the speed estimator and a rotation angle difference between the estimated rotation angle and the measured rotation angle of the rotor;

a measured speed calculator that calculates the measured speed based on the estimated speed combined with the reference signal and the proportional measured speed;

an integrator that calculates the measured rotation angle by integrating the measured speed calculated by the measured speed calculator;

a trigonometric function converter that performs a trigonometric function conversion for the measured rotation angle output from the integrator and outputting the resulting value to the flux observer;

a rotation angle error calculator for calculating a rotation angle error between the estimated rotation angle of the rotor and the measured rotation angle outputted from the trigonometric function converter;

a first gain unit multiplier that multiplies the calculated rotation angle error by a first reference value; and

an adder that adds the estimated speed and the rotation angle error, multiplied by the first reference gain value, and outputs the added value to the reference signal combiner.

9. The sensorless control system as set forth in claim 8, wherein the proportional measured-speed measurer includes:

a flux error calculator that calculates a flux error between a measured flux and an estimated flux on a q-axis among flux components, in a rotational coordinate system, which are output from the flux observer;

a high pass filter that performs a high pass filtering for the flux error calculated by the flux error calculator;

a demodulator that obtains a flux-error proportional value of the rotor based on the filtered value outputted from the high pass filter;

a second gain multiplier that outputs a position-error proportional value to an position error obtained by multiplying the flux-error proportional value from the demodulator by a second reference gain value;

a low pass filter that low pass filters the position-error proportional value output from the second gainmultiplier; and

a proportional integrator that outputs a proportional measured speed obtained by proportional-integrating the filtered value output from the low pass filter.

10. The sensorless control system as set forth in claim 8, wherein the reference signal is obtained by the following equation:

$\eta = 0.8 + 0.2(1\text{-}X)$,

where η denotes the reference signal, and X denotes a variable whose variation is detected by the mode switching controller.

11. The sensorless control system as set forth in claim 7, wherein the first speed is in a range of 950 RPM to 1100 RPM and the second speed is in a range of 800 RPM to 950 RPM.

12. The sensorless control system as set forth in claim 7, wherein as the estimated speed of the motor increases from 800 RPM to 1100 RPM, the variable decreases from 1 to 0, and as the estimated speed of the motor decreases from 1100 RPM to 800 RPM, the variable increases from 0 to 1.

13. The sensorless control system as set forth in claim 12, wherein, as the variable decreases from 1 to 0, the mode switching controller turns off the low-speed-region tracker when the estimated speed of the motor reaches the first speed, and when the variable increases from 0 to 1, the mode switching controller turns on the low-speed-region tracker when the estimated speed of the motor reaches the second speed.

14. A method of measuring a magnetic flux of a synchronous reluctance motor comprising:

estimating a flux of a synchronous reluctance motor by removing higher harmonic components of a current which flows into the motor in a rotational coordinate system;

measuring a flux in a fixed coordinate system by combining a voltage in the fixed coordinate system, which is applied to the motor, and a current in the fixed coordinate system, from which higher harmonic components are removed, with the estimated flux of the motor; and

converting the measured flux of the motor to a measured flux in the rotational coordinate system.

15. The method of claim 14, further comprising:

removing the higher harmonic components of the current in the rotational coordinate system;

selecting and outputting a flux value corresponding to the current, from which the higher harmonic components are removed, with reference to information stored in a look-up table having fluxes in correlation with currents; and

converting the output estimated flux to an estimated flux in the fixed coordinate system.